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EXECUTIVE BODY FOR THE CONVENTION ON LONG-RANGE TRANSBOUNDARY AIR POLLUTION

Working Group on Effects

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RECENT RESULTS AND UPDATING OF SCIENTIFIC AND TECHNICAL KNOWLEDGE

# 2007 JOINT REPORT OF THE INTERNATIONAL COOPERATIVE PROGRAMMES AND THE TASK FORCE ON THE HEALTH ASPECTS OF AIR POLLUTION

Report by the Extended Bureau of the Working Group on Effects

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ANNEXES

## INTRODUCTION

1. The Executive Body, at its twenty-fourth session, decided that the secretariat would prepare the annual review of the activities and results of the International Cooperative Programmes (ICPs) and the Task Force on the Health Aspects of Air Pollution, based on the information provided by the lead countries and the programme centres, in accordance with the Convention's 2007 workplan (item 3.1) and as adopted by Executive Body at its twenty-fourth session (ECE/EB.AIR/89, para 72).

2. At its meeting held in Geneva from 14 to 16 February 2007, the Extended Bureau of the Working Group on Effects (the Bureau of the Working Group, the Chairs of the Task Forces, and the representatives of the programme centres of the ICPs) noted the need to report recent results for the reviews of the Convention protocols and decided to prepare a separate document (ECE/EB.AIR/WG.1/2007/14). The Extended Bureau also agreed that the 2007 joint report should continue to summarize achievements reflecting the 2007 workplan according to pollutant-specific topics, and that workplan items common to all programmes should be reported under cross-cutting issues.

3. This report reviews the main accomplishments of the ICPs and the Task Force on Health under seven topics that follow the 2007 workplan items of the Working Group. The six workplan items common to all programmes are reported in ECE/EB.AIR/WG.1/2007/14 (first item) and in section 7. Details of the general activities of the programmes and the relevant literature are reported in section VIII of this document.

## I. ACIDIFICATION

4. ICP Forests selected from its 500 level II (intensive monitoring) plots where deposition was monitored, between 198 and 230 plots with complete data sets for bulk and throughfall depositions of sulphate ($SO_4$), nitrate ($NO_3$) and ammonium ($NH_4$) for the period 1999–2004. Mean annual $SO_4$ bulk (open field) deposition decreased from 6.7 to 4.9 kg $ha^{-1}$ $year^{-1}$ (198 plots). Throughfall decreased from 8.8 to 6.0 kg $ha^{-1}$ $year^{-1}$ in 2003 and was 6.3 kg $ha^{-1}$ $year^{-1}$ in 2004 (223 plots). $NO_3$ and $NH_4$ bulk depositions decreased less than $SO_4$ depositions. Bulk deposition decreased significantly on 21%, 13% and 16.1 % of the plots for $SO_4$, $NO_3$ and $NH_4$, respectively. Hardly any plots showed a significant increase in bulk deposition.

5. The recovery of surface waters from acidification is continuing, shown by 1994–2004 trend analysis of water chemistry data from ICP Waters sites in Europe (73) and North America (106). $SO_4$ declined less than in the previous 1990–2001 trend analysis and was still the most important acid anion at most sites. The 1994–2004 trends for nitrogen (N) showed no consistent regional pattern. The widespread increases in dissolved organic carbon (DOC) were correlated with $SO_4$ declines. Evidence of a biological response to reduced surface water acidification was, so far, not uniform throughout the study area. Environmental factors other than acid deposition –

"confounding factors" – were expected to affect chemical and biological recovery of freshwaters in response to reduced acid deposition. Climate change may both enhance and delay recovery depending on the region and variable considered.

6. Monitoring data from ICP Waters and ICP Integrated Monitoring as well as other sources showed clear and significant regional trends in surface water chemistry in response to sulphur deposition reductions since the mid-1980s. Waters have become less acidic and less toxic to biota. At many sites, modelled $SO_4$ concentrations approach those predicted to follow full implementation of the 1999 Gothenburg Protocol. There were no consistent trends for $NO_3$, and most sites showed ongoing N accumulation in the catchment. Biological recovery has begun in many regions, but lags behind chemical recovery. Dynamic models indicated that a significant number of sites in several regions of Europe would continue to be acidified after 2010.

7. The critical load database of ICP Modelling and Mapping, currently used in integrated assessment, is based on the call for data made in 2005. The voluntary call for data in 2006, which was not intended for use in integrated assessment, received critical loads data from 16 National Focal Centres (NFCs). Of these, 11 provided dynamic modelling results based on selected emission scenarios from the Coordination Centre for Effects (CCE).

8. The Joint Expert Group on Dynamic Modelling concluded that models, tools and data were well established and available for dynamic acidification modelling of terrestrial and aquatic ecosystems at the European scale. They also enabled the derivation of target loads that connect critical loads to time lags of damage and recovery.

9. The Joint Expert Group on Dynamic Modelling concluded that the time to achieve biological recovery in surface waters from acidification might be delayed or extended as a result of future climate change. The pathway to recovery would not necessarily be the same as the pathway of acidification. A return to historical or "reference" condition might not be achievable.

10. Dynamic model parameters were experimentally adjusted over time to account for increased temperature, rainfall and carbon dioxide ($CO_2$). These changes affected, inter alia, weathering rates, decomposition of organic matter and sea-salt inputs. The Joint Expert Group on Dynamic Modelling concluded that the results clearly indicated the potential impacts of climate change on delayed and accelerated recovery from acidification, which also depended on site-specific catchment characteristics.

## II. NUTRIENT NITROGEN

11. ICP Forests evaluated the N deposition trends for the period 1999–2004. Mean annual bulk $NH_4$ deposition decreased from 5.4 to 4.1 kg $ha^{-1}$ $year^{-1}$ (205 plots), and throughfall from 5.7 to 4.5 kg $ha^{-1}$ $year^{-1}$ (230 plots). Mean bulk $NO_3$ deposition decreased from 4.5 to 3.6 kg $ha^{-1}$ $year^{-1}$ (206 plots), and throughfall from 6.0 to 4.7 kg $ha^{-1}$ $year^{-1}$ (231 plots).

12. ICP Forests evaluated relations between forest growth and environmental factors with data from 363 level II plots. High N deposition enhanced the growth of spruce and pine and for beech trees the relation was positive but statistically not significant. On sites that were already N-saturated, this relation was weaker. Indirect relationships between N deposition and defoliation were observed on ICP Forests plots in Germany. Exceedance of critical loads for nitrogen correlated negatively with soil pH and base saturation. Soil conditions were found to be a deciding factor for tree crown condition.

13. N deposition clearly influenced ground vegetation species composition on 488 ICP Forests plots mostly in central Europe. N-indicating plants occurred more frequently on plots with high N deposition.

14. ICP Vegetation programme centre received data on the total N concentration in mosses from 10 countries. Altogether, 18 countries participated in the 2005/2006 survey.

15. Carbon (C) and N accumulate together in forest soil organic matter with closely linked process dynamics. ICP Integrated Monitoring found a threshold N deposition of 8–10 kg $ha^{-1}$ $year^{-1}$, below which almost no leaching occurred. The leaching and retention of N were mainly determined by N deposition, the organic layer carbon-nitrogen ratio (C/N ratio), and the annual temperature. N deposition determined N leaching at $C/N<23$. At higher C/N ratios both N deposition and temperature were important.

16. The critical load database of ICP Modelling and Mapping, currently used in integrated assessment, is based on the call for data made in 2005. The voluntary call for data in 2006 was not intended for use in integrated assessment. Preliminary exceedance of critical loads of N, based on submitted data or the CCE background database, showed that 42% of the European ecosystems would be unprotected in 2010. Exceedance of empirical critical loads provided an ecologically specified indication of the risk of N for biodiversity. Thirty-three per cent of the European area of (semi-)natural vegetation, including some Natura 2000 sites of the European Union, would be unprotected in 2010.

17. The Workshop on effects of low-level nitrogen deposition, in particular N critical loads for terrestrial ecosystems in low deposition areas, was held in Stockholm from 29 to 30 March 2007. It concluded that current critical loads for nutrient N for in boreal and arctic areas were deemed too high to prevent major vegetation changes. The proposed critical loads were 10 kg N $ha^{-1}$ $year^{-1}$ for boreal ecosystems and <8 kg N $ha^{-1}$ $year^{-1}$ for bogs and poor minerotrophic mires, based on robust expert judgments on available empirical data.

18. The Joint Expert Group on Dynamic Modelling considered it important to treat N in reduced and oxidized forms, as they had different sources and potentially different impacts on biodiversity and eutrophication. Soil process representation in dynamic models was deemed adequate, but links between reduced and oxidized forms to ecosystem responses were not well understood. Biodiversity relevant indicators existed for aquatic systems (in particular impacts of

high N concentrations on algal populations and macrophytes), but relevant indicators and damage thresholds for terrestrial ecosystems were lacking.

## III. OZONE

19. Ozone ($O_3$) concentrations were measured in 2004 on 106 level II plots of ICP Forests, located mainly in central and southern Europe. Only 10 plots had mean concentrations above 45 parts per billion (ppb) from April to September. Mean concentrations were below 60 ppb at all sites. The comparison on critical levels and impacts is ongoing.

20. Visible leaf injury on white clover (*Trifolium repens cv Regal*) was observed at the majority of ICP Vegetation $O_3$ biomonitoring sites in 2006. This was in agreement with exceedance of the concentration-based critical level for agricultural crops and (semi-) natural vegetation (dominated by annual species) at over 60% of the sites. The application of brown knapweed (*Centaurea jacea*) as a biomonitor required further development, as the assessment of visible leaf injury in 2006 was confounded by uneven plant development and difficulties in identifying the cause of observed injury.

21. The ICP Vegetation developed a model that related relative $O_3$ sensitivity of species of (semi-)natural vegetation to their Ellenberg indicator values for light and salinity. The model closely predicted actual change in biomass observed at a grassland community exposed to $O_3$ for five years in a field-scale experiment in Switzerland. For the United Kingdom, the Ellenberg model predicted that *Festuca ovina-Avenula pratensis* grassland and *Bromus erectus* grassland communities were the most sensitive.

22. Literature reviews and monitoring conducted by the ICP Vegetation have indicated that over 200 species of crops and (semi-)natural vegetation were responding to $O_3$ at current or recent concentrations in the ECE region. Responses included the development of visible injury, such as small yellow or bronze spots on the leaf surface, and reductions in growth, seed production, and/or ability to over-winter (for perennial species). $O_3$ injury had been detected every year in 1990–2006 across 17 countries representing the width and length of Europe. Trends in impacts reflected the spatial and temporal variation in concentrations, with no marked decline or increase evident.

23. ICP Vegetation, in collaboration with Meteorological Synthesizing Centre-West of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants (EMEP/MSC-W) and ICP Forests, defined $O_3$ flux parameterizations for a generic crop and two generic tree species in Europe for use in integrated modelling and mapping risk of damage. Modelled accumulated fluxes indicated that the risks for crops and deciduous forests were highest in central and southern Europe. The gradient between northern and southern Europe was much lower for the flux than for the concentration-based indices. The modelled fluxes to a generic Mediterranean evergreen tree were much lower than those for a generic deciduous tree,

which was due to an improved representation of summer drought-induced reductions in $O_3$ uptake in the Mediterranean region.

24. ICP Modelling and Mapping revised critical levels of $O_3$ and of ammonia for inclusion in the *Manual on Methodologies and Criteria for Modelling and Mapping Critical Loads and Levels and Air Pollution Effects, Risks and Trends*, based on recommendations of ICP Vegetation, ICP Forests and the Convention's Workshop on atmospheric ammonia: detecting emission changes and environmental impacts. Additional changes proposed by ICP Materials on new dose-response functions, tolerable corrosion levels, soiling of materials and stock at risk were also adopted.

25. The health assessment of $O_3$ conducted for the *Air Quality Guidelines* of the World Health Organization (WHO) confirmed the relation between ambient air concentrations and mortality, mainly due to respiratory diseases. Increases in total mortality have been observed at low concentrations of 75 $\mu g\ m^{-3}$ (one-hour mean). The new guideline was set at 100 $\mu g\ m^{-3}$ or 50 ppb (8-hours mean). Even at this level, a 1–2% increase of mortality was expected, since the most sensitive individuals could be affected below this exposure level. High $O_3$ or particulate matter (PM) concentrations could act in synergy with climate, increasing mortality during heatwaves.

## IV. PARTICULATE MATTER

26. The Task Force on Health noted that the evidence on PM and public health reviewed by the WHO *Air Quality Guidelines* was consistent in showing adverse health effects at exposures experienced by urban populations in cities throughout the world. The risk for various outcomes has been shown to increase with exposure, and there was little evidence to suggest a threshold, below which no adverse health effects would be anticipated. The epidemiological evidence showed adverse effects of particles after both short- and long-term exposures.

27. Long-term exposure to air pollution also contributed to disease development. The attribution of the effects to specific PM characteristics remained limited. However, some results suggested differential toxicity among PM components for a given health endpoint, as well as differences in the affected health endpoints themselves.

## V. HEAVY METALS

28. ICP Vegetation programme centre received data on the heavy metal concentrations in mosses from 17 countries. Altogether, 32 countries participated in the 2005/2006 survey.

29. Budget calculations on heavy metal fluxes and budgets at ICP Integrated Monitoring sites indicated sharply decreasing lead (Pb) concentrations in the biologically important humus layers, and cadmium (Cd) seemed to decrease. No changes were detected for mercury (Hg). Experimental foundation for assigning possible risks from Hg on soil biota has been supported

by new experiments, e.g. hampered decomposition. Humus layers were at risk in southern Sweden due to current Hg deposition.

30. CCE prepared, in collaboration with other institutions, a report on “Heavy metals emissions, depositions, critical loads and exceedances in Europe” (available at: www.mnp.nl/cce). It addressed nine heavy metals and concluded that effects expected from the three priority heavy metals (Hg, Pb and Cd) were the most relevant, and that therefore the focus on them was justified from an effects-based perspective. The assessment using three different emission scenarios indicated that the protected ecosystem area increased between 2000 and 2020. However, 74% and 19% of area remained at high risk in 2020 for Hg and Pb, respectively. The contribution from agricultural practices required further attention on the risks from all Cd inputs.

31. ICP Modelling and Mapping prepared and delivered effects-based approaches for the use of the Task Force on Heavy Metals and its sufficiency and effectiveness report and in the Working Group on Strategies and Review. Needs and feasibility of effects-based approaches and data availability were documented. The critical loads available were based on sound science and could be used for work under the Convention, e.g. to evaluate emission reduction scenarios. Remaining uncertainties were largely driven by the quality of national emission data.

## VI. PERSISTENT ORGANIC POLLUTANTS

32. The Task Force on Health received no requests from the Working Group on Strategies and Review for revising the health risk assessment of persistent organic pollutants (POP). Therefore, no work on health hazard evaluation was initiated.

## VII. CROSS-CUTTING ISSUES

33. ICP Forests carried out international cross-comparison courses for defoliation assessment in Norway, the Slovak Republic and Spain in 2006. In most of the assessed stands, good agreement between the different observers was reached.

34. ICP Waters sent samples to 73 laboratories for the annual chemical intercomparison and 67 laboratories in 26 countries submitted results. Based on the general target accuracy of ±20%, 75% of the overall results were considered as acceptable. The best results were reported for the analytical variables sodium and $SO_4$, with 88% and 89% acceptable results, respectively. The lowest percentage of acceptable results was observed for the heavy metals, especially for lead, zinc and nickel, with 52%, 61% and 63% acceptable results, respectively.

35. The tenth intercalibration of invertebrates of ICP Waters received contributions from five laboratories. The laboratories identified a high portion of the individuals in the test samples, usually >95% of the total number of species. The taxonomic quality was sufficient for stating the acidity index. The quality assurance index indicated good taxonomic work for all laboratories.

36. ICP Materials compiled corrosion maps for the Czech Republic, Germany and Switzerland for the years 1990 and 2000 for cast bronze, copper, zinc, carbon steel and Portland limestone. Similar maps were compiled at the urban scale for Milan and Berlin. For all materials and resolutions, corrosion had reduced significantly since 1990. In 2000, only a few areas were exceeding tolerable corrosion levels at the country level, but at the urban level a substantial amount of areas had been exceeded.

37. ICP Materials carried out a study on increased risk for corrosion, including stock of cultural heritage materials at risk. The geographical distribution of limestone (76%), rendering (7%), painting (15%), and other facade materials (2%) along the banks of Seine River in Paris, a World Heritage site of UNESCO, was determined on 525 facades.

38. Based on ICP Materials exposure data in 2005/2006, the average corrosion trend for carbon steel was no longer decreasing. For some sites with an overrepresentation of sites with low annual mean temperature, corrosion of carbon steel had increased substantially compared to earlier exposures in 2002/2003.

39. The Workshop on protection of cultural heritage from air pollution: the need for effective local policy, maintenance and conservation strategies was held on 15 and 16 March 2007 in Paris. The workshop noted three important aspects in heritage management strategies: soiling impact analysis based on public perception and optical measurements; time between interventions; and costs of maintenance, conservation and renovation.

40. The following sections cover the workplan items common to all programmes. They comprise information on pollutants covered by the Gothenburg Protocol. In these sections, those bodies not running monitoring networks report on the data they employ in their work.

## A. Recent information on effects-based approaches for the Protocol reviews

41. Information for the support for the review of the Gothenburg Protocol is reported in document ECE/EB.AIR/WG.1/2007/14.

## B. Dose-response functions and stock at risk

42. The soil solid phase, reacts much slower to atmospheric deposition and statistical relationships between soil condition and tree condition are more difficult to obtain. ICP Forests found scientific evidence that acidified soils destabilize forest ecosystems. Tree crown condition showed in some cases significant relations with depositions, but these were masked by stronger influences of site conditions. In particular, $SO_4$ deposition was found to be related to defoliation of Scots pine. N concentrations in the soil solution were linked to atmospheric nitrogen inputs, especially on N saturated plots. A significant relation between N deposition and ground

vegetation species composition had been shown. Effects of deposition on epiphytic lichen species are comparatively strong.

43. Sulphate concentrations in surface waters respond rapidly to changes in S deposition. Typically, 90% of incoming N deposition is retained by the catchment soil, but moderate to high N deposition leads to elevated $NO_3$ concentration in runoff. There are solid empirical relationships between dose (acid neutralizing capacity, ANC) and response (lake fish status, invertebrates in running waters and diatoms in lakes). Lake fish stocks were quantified in Norway, Sweden and Finland, three European countries most affected by acidification. Fish were estimated to be present in 82% of the 126,482 lakes in these countries. The stock for the four most frequently lost species (brown trout, roach, perch, and Arctic char) exceeded 10,000. Andronomous species were also estimated, in particular salmon, which is present in more that 200 rivers in northern Europe.

44. ICP Materials compiled two sets of dose-response functions for corrosion based on its monitoring data for the exposure of materials. Only a few studies, for limited areas, were available to estimate the stock at risk. The first set was based on data after one, two, four and eight years of exposure from the first programme (1987–1995). This data included various materials (seven metals, two stone materials, two paint coatings and two glass materials representative of medieval stained glass windows) and exposure conditions for sulphur dioxide ($SO_2$) concentration (for unsheltered and sheltered specimens) and acid rain (for unsheltered only). This first set was for long exposure times, or for pollution dominated by $SO_2$. The second set was based on data after one, two and four years of exposure from the second, multi-pollutant, programme (1997–2001). It was complemented with one-year data for nitric acid ($HNO_3$) and PM (2002–2003). It covered unsheltered condition for $SO_2$, $HNO_3$, PM and acid rain depending on selected material. This second set should be used when $SO_2$ was not dominating. $O_3$ was included for copper only, and $HNO_3$ was included for zinc and limestone. $PM_{10}$ was included in the corrosion dose-response functions for carbon steel, bronze and limestone. It also contributed to soiling.

45. ICP Vegetation assessed 23 crops and 89 vegetation species in Europe. Concentration-based dose-response functions for growth or yield reductions for 23 crops were derived from the literature. Concentration- and flux-based response functions had been derived for the effect of ozone on the biomass of white clover using data from the biomonitoring programme. Stomatal flux-based dose-response functioned for yield reductions, based on all available monitoring data in Europe, had been derived for wheat and potatoes, and provisionally for beech and birch. Concentration-based response functions had also been derived for 89 species of (semi-)natural vegetation. Application of these functions to plant community data indicated that grasslands, heathlands, scrub, tundra, mires, bogs and fens had the highest proportions of ozone-sensitive plant communities.

46. Catchment ecosystems selected to ICP Integrated Monitoring network reflected large-scale nature conditions and enabled data collection for a variety of models covering significant

ecosystem functions. The epiphytic lichen flora at 25 European sites in areas far from air pollution sources was statistically related to measured air pollution levels and climatic data. Not only sulphur, but also N compounds had a strong influence of the occurrence of acidophytic lichen species.

47. ICP Modelling and Mapping compiled data on ecosystems that NFCs have selected as sensitive ecosystems to be protected and for which critical loads have been calculated, including forests, semi-natural vegetation and inland waters (about 4 million $km^2$). Vegetation types were distinguished according to the EUNIS (European Nature Information System) classification. Over 100 vegetation classes had been distinguished by some NFCs, which provided up to thousands of calculation points in a 50 km × 50 km grid cell. The CCE database included the Convention’s harmonized land-cover map, with major tree species and ecosystem types in Europe. NFCs had defined various indicators and critical limits for acidification of soils and waters and eutrophication. Critical loads for acidification were based mainly on the base cations to aluminium ratio (BC/Al) or Al and hydrogen concentrations in soil solution to avoid damage to tree roots, groundwater contamination and various other effects. Computed critical loads for eutrophication were based on $NO_3$ concentrations in soil solution and aimed at avoiding biodiversity loss and various other effects.

48. The total population of the 25 European Union Member States was included in health risk assessment conducted by the RAINS model, with a division between urban and rural populations. Based on a meta-analysis of studies on health effects of $O_3$ exposure by WHO, the Task Force on Health determined that the risk for all-cause mortality would increase linearly with a coefficient of the concentration-based dose-response function, of 1.003 for a 10 $\mu g\ m^{-3}$ increase in the daily maximum 8-hour mean. The range used was over 70 $\mu g\ m^{-3}$ and the 95% confidence interval was 1.001–1.004. The risk estimate for all-cause mortality associated with PM exposure was derived from a large cohort study in North America. The linear increase in relative risk (a concentration-based dose-response function) was 1.06, for a 10 $\mu g\ m^{-3}$ increase in annual mean $PM_{2.5}$. The 95% confidence interval was 1.02–1.011. The WHO *Air Quality Guidelines* also assigned “interim targets” for $O_3$, PM and $SO_2$ for highly polluted areas. These were proposed as incremental steps in progressive reduction of air pollution and risk of specific health effects.

49. The Joint Expert Group on Dynamic Modelling compiled complementary information from studies outside the Convention work. The target ecosystems included trees, soils and fish (brown trout and salmon). Experimental datasets were used to derive dose-response functions for vegetation modelling. For acidity, these were mostly based on ANC and pH rather than BC/Al. For eutrophication, they were based on a range of soil and soil solution variables. In general, dose-response functions between surface water acidity and biological impacts, based on ANC and pH, were deemed well defined. Evidence suggested that nutrient N significantly affects oligotrophic surface waters, but dose-response functions did not yet exist. Relationships between nutrient N and key species in terrestrial and aquatic ecosystems were poorly known.

## C. Links between observations and critical thresholds, loads and levels

50. ICP Forests evaluated studies on plots in Germany and Italy and also in North America, where its methods were applied. They indicated that the exceedance of critical loads of acidity and that N was related to harmful effects to various compartments of forest ecosystems, depending on the intensity and duration of depositions and on ecosystem properties. In particular, the symptoms observed on plots with critical loads exceedances were: decreasing pH values and base saturation on forest soils; lower C/N ratios in the humus layer leading to higher N contents in the foliage of forest trees; increasing sulphur contents in the foliage; and decreasing foliage and growth as well as increasing tree death.

51. ICP Waters found generally good agreement between exceedance of critical loads for acidity and measured ANC in surface waters based on its monitoring and data from literature. Time delays of damage and recovery were well explained by known catchment and water processes

52. ICP Materials observed the highest exceedance in the test-site network in industrial areas with high pollution levels, in urban areas with high impact of traffic, and in areas affected by seasalt aerosols.

53. Literature studies on crops exposed to filtered and non-filtered ambient air indicated, inter alia, that fluxes exceeding the critical level led to reductions in growth and yield in Italy, Spain and Sweden. $O_3$-induced leaf injury on (semi-)natural vegetation was widespread across Europe, and had frequently been recorded in regions with low ozone concentrations but modelled high ozone stomatal fluxes. The standardized white clover biomonitoring programme of ICP Vegetation also confirmed $O_3$-induced leaf injury at almost every site in every year during the period 1996–2006. Biomass reductions in white clover were common in central and southern Europe, where critical levels were frequently exceeded. Trends in impact reflected the spatial and temporal variation in ozone concentration, with no marked decline or increase evident.

54. Input-output calculations with ICP Integrated Monitoring data confirmed earlier assessments indicating that N deposition of 8–10 kg $ha^{-1}$ $year^{-1}$ was a critical threshold for elevated $NO_3$ leaching.

55. ICP Modelling and Mapping had not compiled information on links between observed effects and of critical load exceedance, as these have been shown by ICPs' monitoring data and literature studies.

56. The Task Force on Health confirmed with recent results health impacts of PM and $O_3$ described earlier. New epidemiological and toxicological studies verified acute health events, such as deaths, but also increased understanding of pathological processes and less severe health outcomes related to these pollutants.

57. The Joint Expert Group on Dynamic Modelling had no additional information on studies linking observed effects to critical load exceedances.

### D. <u>Review of the robustness of monitored and modelled air pollution impacts</u>

58. ICP Forests would report on the robustness at a later stage.

59. ICP Waters sites covered most of the acid-sensitive areas in Europe that received significant acid deposition. Many of these sites were especially sensitive to acidification. They did not need to be representative of all surface waters in a region, but rather represented the acid-sensitive surface waters.

60. ICP Materials calculated corrosion as an arithmetic average of three identical specimens. Based on the variation of these triplicates, the statistical uncertainty for the reported average standard deviations was between 2% and 5%, depending on material. Each individual parameter in a dose-response function was selected based on a 95% confidence criterion. The corrosion values predicted by dose-response functions were more uncertain than direct measurements, with standard deviation of 30 to 50%, depending on material. In addition, there was natural variation in corrosion, which occurred even when pollution load was constant, due to varying climatic conditions. No estimates for soiling uncertainty existed yet.

61. ICP Vegetation derived critical levels for $O_3$ from concentration-based dose-response functions with 95% and 99% confidence intervals for crops and trees, respectively. The uncertainty of concentration-based estimates on yield losses for 23 crops in 47 countries in Europe was mostly influenced by the dose-response function for vegetables due to lack of dose-response data; the factor for converting ozone at 50 m to ozone at canopy height; yield uncertainty due to year to year variation; dose-response function for potato due to either variation in response in different climates or the use of different cultivars in experimentation; and the annual variability of $O_3$ concentrations.

62. ICP Integrated Monitoring had concluded that soil N retention was one of the most uncertain parameters in the calculation of critical loads. The change in soil C/N ratio was found important. Climate change might either enhance or delay recovery from elevated S and N deposition loads, depending on the region and variable considered.

63. ICP Modelling and Mapping established the robustness of critical loads and dynamic modelling results using various methods, including quality assurance procedures of national data submissions (including selection of ecosystems and criteria), comparison with or use of the background database, European land-cover data, and multilateral cooperation to compare methods and data at NFCs. An evaluation showed that changes in deposition model formulation had a larger impact on the quantification of risks than updates in critical loads.

64. The Task Force on Health used recent studies to confirm the theoretically expected bias in PM impacts. The bias arose from basing the estimates of exposure to air pollutant exclusively on routinely collected air quality data, which were applied as a mean value to wide areas and population groups. Recent exposure assessments based on more detailed observations and modelling led to effects estimates, which were a factor 2–3 higher than earlier studies.

65. The Joint Expert Group on Dynamic Modelling had tentatively noted that dynamic models were virtually certain for use in predictions for acidification and that they very likely described time delays involved. Dynamic models were deemed virtually certain in correctly predicting N enrichment of ecosystems, which might very likely lead to further changes in biodiversity. It was considered very likely that chemical and biological recovery would take many decades, assuming emissions of the Gothenburg Protocol and systems might likely be irreversibly changed.

## E. Observed parameters, methodologies, spatial and temporal extent of effects-oriented monitoring

66. Most of the effects-oriented programmes had set up monitoring networks, which varied in the observed parameters, mainly according to the target ecosystems of the programme, and also in their spatial and temporal coverage. Some bodies relied on modelled data or analyses of other studies. ICP Vegetation noted that it was moving away from the standardized ozone biomonitoring experiments with white clover and brown knapweed to field surveys on ozone-induced leaf injury on crops and (semi-)natural vegetation. ICP Modelling and Mapping compiled data from NFCs, which often base their work on monitored national data, and updated information from NFCs, which have used both monitored and modelled data to compile critical loads. The Task Force on Health evaluations were based on evidence from worldwide research. The Joint Expert Group on Dynamic Modelling discussed modelling work of ICPs and research projects outside the Convention.

67. Table 1 presents an overview of the environmental compartments observed or employed by effects-oriented bodies on at least half of their plots. A more detailed table is made available as an informal document. The data will be updated in 2008 with in-depth information on surveys, monitoring and modelling activities.

**Table 1.** Environmental compartments that are observed or employed by effects-oriented bodies. Abbreviations: x = monitored, - = not monitored, I = level I sites, II = level II sites, HM = heavy metals, CL = critical load, DM = dynamic modelling.

| | ICP Forests (II) | ICP Waters | ICP Materials | ICP Vegetation | ICP Integrated Monitoring | ICP Modelling and Mapping | Task Force on Health | Joint Expert Group on DM |
|---|---|---|---|---|---|---|---|---|
| number of sites (and countries) | I: 6,000 II: 800 | 202 (14) | 25 (16) | $O_3$: 23 (12); mosses: 7000 (32) (HM), 3200 (18) (N) | 47 (17) | Data from NFCs: >1,000,000 (CL: 19, DM: 11) (in 2007). Other countries: CCE background database | Population in the whole Europe | 12 regions across Europe (8) |
| meteoro-logical data | x | - | x | x | - | x | - | - |
| air concentration | x | - | x | x (also modelled) | x | modelled | modelled | modelled |
| atmospheric deposition | x | - | x | modelled | x | modelled | - | modelled |
| waters | - | x | - | - | x | x | - | x |
| soils | x (also I) | - | - | x | x | x | - | x |
| vegetation | x | - | - | x | x | x | - | - |
| trees | x (also I) | - | - | - | x | - | - | - |
| fauna | - | x | - | - | x (few sites only) | - | - | - |
| materials | - | - | x | - | - | - | - | - |
| health | - | - | - | - | - | - | x | - |

## F. Effects-oriented activities in Eastern Europe, Caucasus and Central Asia

68. The Working Group on Effects has encouraged EECCA countries to participate in its sessions and activities. Table 2 presents an overview of the participation of these countries in the annual meetings of the effects-oriented bodies and on the submissions of data for the programme centres.

**Table 2.** Official participation of EECCA countries in the annual meetings (column 'mtg') of effects-oriented bodies and submitted data concerning the noted year (column 'data') during the past three years or at any earlier time. For abbreviations see table 1.

| | ICP Forests (II) | | ICP Waters | | ICP Materials | | ICP Vegetation | | ICP Integrated Monitoring | | ICP Modelling and Mapping | | Task Force on Health | Joint Expert Group on Dynamic Modelling |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mtg | data | mtg | data | mtg | data | mtg | data | mtg | data | mtg | data | mtg | mtg |
| Armenia | | | | | | | | | | | | | 2007 | |
| Belarus | | 2005<br>2006<br>§ | 2006 | 2006 | | | | 2005<br>(HM) | 2005<br>2006<br>2007 | 2005 | 2005<br>2007 | 2005 | 2006<br>2007 | |
| Azerbaijan | | | | | | | | | | | | | 2007 | |
| Georgia | | | | | | | | | | | 2007 | | 2005<br>2006<br>2007 | |
| Kazakhstan | | | | | | | | | | | | | 2007 | |
| Kyrgyzstan | | | | | | | | | | | | | 2006<br>2007 | |
| Moldova | | 2005<br>2006<br>§ | | | | | 2007 | | | | | 1998 | 2006<br>2007 | |
| Russian Federation | 2005<br>2006 | 2002<br>§,<br>1996<br>(soil) | 2006 | 2006 | | 1987–<br>2003 | 2005<br>2006<br>2007 | 2007¤<br>(HM) | 2005<br>2006<br>2007 | 2005 | 2005<br>2006<br>2007 | 2005<br>2006<br>2007 | 2005<br>2006 | |
| Tajikistan* | | | | | | | | | | | | | | |
| Turkmenistan* | | | | | | | | | | | | | | |
| Ukraine | 2005 | 2005<br>2006<br>§ | | | | | 2007 | 2007<br>($O_3$)<br>2007¤<br>(HM) | | | 2005<br>2006<br>2007 | 2005<br>2006<br>2007 | 2005 | |
| Uzbekistan* | | | | | | | 2007 | | | | | | | |

* Not Party to the Convention.
¤ Data for moss survey in 2005–2006 will be supplied in 2007.
§ Data for defolitation on level I plots.

## VIII. REVIEW OF RECENT EFFECTS-ORIENTED ACTIVITIES

69. Information on the general activities carried out by ICPs and the Task Force since the twenty-fifth session of the Working Group on Effects and the most important recent publications of their results are summarized in annexes I–VII of this report. Note, that the references have been reproduced as received by the secretariat.

# Annex I

## International Cooperative Programme on Assessment and Monitoring of Air Pollution Effects on Forests (ICP Forests)

1. The twenty-third Task Force meeting took place from 12 to 16 May 2007 in Zvolen, Slovak Republic, and was attended by 65 experts and national representatives from 28 countries. It addressed the following main topics:

(a) Future strategy of ICP Forests;
(b) Cooperation with the European Commission and Life+ financing mechanism;
(c) Implementation of a European forest monitoring system in collaboration with other organizations and project proposals for acquisition of additional external funding;
(d) Integrated evaluation of existing level I and level II data;
(e) Deposition measurements and dynamic modelling;
(f) Abiotic influences on forest condition, such as insects, fungi and fire.

2. The Task Force adopted the strategy of ICP Forests for 2007–2015. It also adopted new parts of its *Programme manual* as well as the technical and executive reports on forest condition in Europe.

3. The programme coordinating group convened on 6 and 7 December 2006 and on 27 and 28 March 2007 in Hamburg, Germany, and developed a strategy for ICP Forests. Integrative project proposals for future monitoring, evaluation and funding were compiled. To this end, the group was extended to include additional experts and country representatives. Close contacts were maintained with the European Commission and its presidency Member State regarding obtaining further co-financing of the monitoring activities after the termination of the Forest Focus regulation in 2006.

4. Monitoring of 6,100 level I plots and 800 level II (intensive monitoring) plots continued. Results were published in the 2007 technical report (Lorenz et al. 2007) and in the 2007 executive report (Fischer et al., 2006). The monitoring data were evaluated as follows:

(a) Mean deposition of ammonium, nitrate and sulphate on level II plots, as well as the temporal development of deposition for the years 1999–2004;
(b) Evaluation of critical loads for acidity and nutrient nitrogen on 186 level II plots and calculation of exceedance by present deposition, in cooperation with the ICP Modelling and Mapping;
(c) Application of the very simple dynamic (VSD) model on 158 level II plots, in cooperation with the ICP Modelling and Mapping;

(d) Comparison of bulk deposition measurements on level II plots with modelled deposition values of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP);

(e) Relationships between forest growth and nitrogen deposition on 363 level II plots in collaboration with the Dutch institute, Alterra;

(f) Evaluation of mean ozone concentrations for the year 2004 on 106 level II plots;

(g) Temporal and spatial trends of large scale forest condition (defoliation) on 6,100 level I plots; evaluation of the influence of biotic damage causes, such as insects and fungi;

(h) Biological diversity of vegetation and lichen species in relation to stand structure and other environmental influences, such as deposition on around 100 level II plots;

(i) Application of a new forest type classification for level I and level II plots.

5. The programme centre of ICP Forests continues to contribute to database management of level I and level II data in collaboration with the European Commission and private consultants. Routine data submission and validation are ongoing. Technical data submission reports have been compiled. The centre has direct access to the validated raw data and datasets. Plot-specific results of previous evaluations are maintained in the programme centre's database. The centre closely cooperates with the European Commission in the BioSoil project, which aims at a repetition of a previous soil survey of 4,000 level I plots and at the implementation of a number of surveys in the field of biological diversity on the same plots. The biodiversity component, led by the programme centre (ForestBIOTA project) and completed in 2006, was based on a test phase on 100 level II plots.

6. A new committee on quality assurance was created under the programme coordinating group to ensure and document data quality throughout the complete monitoring programme. The existing working group on quality assurance in laboratories will continue its work under this new committee.

7. A number of coordination activities are routinely carried out by the programme centre including:

(a) Participation in expert panel meetings;

(b) Representation of the programme at policy meetings and scientific conferences;

(c) Maintenance of the programme's website (www.icp-forests.org);

(d) Data provision to third parties upon request;

(e) Update of the manual for harmonized sampling and monitoring, in close collaboration with involved national experts. Data submission formats for the year 2007 were specified in new central format descriptions.

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# Annex II

## International Cooperative Programme on Assessment and Monitoring of Acidification of Rivers and Lakes (ICP Waters)

1. The twenty-second Task Force meeting was held in Bergen, Norway, on 11 and 12 October 2006. It was attended by 34 experts from 17 Parties to the Convention. At present, 21 countries participate in the activities of ICP Waters.

2. The Task Force considered reports from ICP Waters activities since the last meeting, as well as results from intercalibration and intercomparison exercises.

3. The Task Force also considered progress reports from the programme centre and the national focal centres on results on trends in water chemistry, biological response, heavy metals and dynamic modelling. The presentations are published in ICP Waters report 88.

4. The Task Force considered the following reports: (a) a report on the biological intercalibration of invertebrate fauna, (b) a report on chemical intercomparison, and (c) a report on trends in surface water chemistry and biota, and on the importance of confounding factors.

5. The 2006 biological intercalibration included invertebrates from six countries. Altogether, 14 countries participate regularly.

6. The 2006 chemical intercomparison included determination of major ions and heavy metals. Sixty-seven laboratories in 26 countries participated. The overall results were considered acceptable. Five laboratories from Asia participated for the first time in the intercalibration.

7. The report on trends confirmed that the recovery of surface waters from acidification was continuing. Sulphate concentrations were decreasing, while nitrate trends showed no consistent regional pattern. Alkalinity concentrations, acid neutralizing capacity and pH showed positive trends in most regions. Increased organic acidity and sea salt deposition delayed chemical recovery in some regions. Rates of sulphate decline appeared to be lower than in the previous trend analysis for the period 1990–2001. Sulphate was still the most important acid anion at most ICP Waters sites.

8. Evidence of biological response to reduced surface water acidification was not uniform in the study area. Long-term biological monitoring data showed signs of recovery of invertebrates in Canada, the Czech Republic and Norway. However, at most acidified central European sites there was little evidence of biological recovery.

9. The Task Force also considered results from the joint Workshop on Confounding Factors in Recovery from Acid Deposition in Surface Waters, held in Bergen, Norway, on 9 and 10 October 2006. The proceedings were published later in 2006 as ICP Waters report 88. The workshop concluded that environmental factors other than acid deposition, so-called "confounding factors", were expected to affect chemical and biological recovery of freshwaters in response to reduced acid deposition. Climate contributed considerably to the variability of surface water chemistry, e.g. through sea-salt episodes (increasing water acidity and setting back biological recovery), droughts (enhances acidic episodes) and soil freezing and thawing (increasing nitrate leaching). Climate change may both enhance and delay recovery, depending on the region and the variables considered.

10. The ICP Waters report on support for the review and possible revision of the Convention Protocol was presented and discussed

11. Representatives of the ICP Waters programme centre actively participated in the meetings of the Task Forces on ICP Integrated Monitoring, ICP Modelling and Mapping, and ICP Forests, as well as the Joint Expert Group on Dynamic Modelling.

<u>Literature</u>

ICP Waters report 85/2006. Biological intercalibration 1006: Invertebrate fauna.

ICP Waters report 86/2006. Intercomparison 0620. pH, K25, HCO3, NO3+NO2, Cl, SO4, Ca, Mg, Na, K, total aluminium, aluminium - reactive and nonlabile, TOC, COD-Mn. Fe, Mn, Cd, Pb, Cu, Ni and Zn.

ICP Waters report 87/2006. Trends in surface water chemistry and biota; the importance of confounding factors.

ICP Waters report 88/2006. Joint Workshop on Confounding Factors in Recovery from Acid Deposition in Surface Waters, 9–10 October 2006, Bergen, Norway. Summary and abstracts.

# Annex III

## International Cooperative Programme on Effects of Air Pollution on Materials, Including Historic and Cultural Monuments (ICP Materials)

1. The twenty-third meeting of the Task Force was held in Paris on 12 and 13 March 2007.

2. The Workshop on Protection of Cultural Heritage from Air Pollution: the Need for Effective Local Policy, Maintenance and Conservation Strategies was held in Paris from 15 to 16 March 2007. It was organized in the Centre de Recherche et de Restauration des Musées de France at the Louvre Palace.

3. Environmental and corrosion data for carbon steel, zinc and limestone were compiled for the material exposures in 2005–2006 (see reports 52–55). Soiling of modern glass and Teflon filters was also studied at exposure sites.

4. New exposure stations in Sofia and Vienna were included in the test site network.

5. ICP Materials is preparing a revised version of chapter 4 to the *Manual on methodologies and criteria for modelling and mapping critical loads and levels and air pollution effects, risks and trends*.

6. Mapping and assessment of stock of materials at risk have been reported.

Literature

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Report 54. Results from the 2005–2006 trend exposure programme. Corrosion attack of zinc after 1 year of exposure.

Report 55. Results from the 2005–2006 trend exposure programme. Corrosion attack of limestone after 1 year of exposure.

## Annex IV

### International Cooperative Programme on Effects of Air Pollution on Natural Vegetation and Crops (ICP Vegetation)

1. The twentieth meeting of the Task Force was held in Dubna, Russian Federation, from 5 to 8 March 2007. It was attended by 66 experts from 24 countries, including 23 experts from four countries in Eastern Europe, the Caucasus and Central Asia (EECCA), as well as representatives of ICP Modelling and Mapping and the Bureau of the Working Group on Effects. The following main topics were addressed:

(a) Future experimental programme on ozone;
(b) Ozone critical levels – further developing and applying the flux-based method;
(c) Field-based evidence on the impacts of ozone on vegetation;
(d) Temporal trends of heavy metal concentration in mosses;
(e) Progress of the 2005/2006 European survey on heavy metals and nitrogen concentrations in mosses.

2. The parameterization of the ozone flux model for generic tree species (deciduous and Mediterranean evergreen) for use in large-scale and integrated assessment modelling was finalized by the forest expert group established during a workshop in Obergurgl, Austria (see ECE/EB.AIR/WG.1/2006/11). Annex III of chapter 3 in the *Modelling and mapping manual* was revised accordingly and adopted at the twenty-third Task Force meeting of ICP Modelling and Mapping.

3. New critical levels of ammonia for vegetation were recommended at the Workshop on Atmospheric Ammonia: Detecting Emission Changes and Environmental Impacts (see ECE/EB.AIR/WG.5/2007/3). ICP Vegetation and ICP Modelling and Mapping adopted the new critical levels of ammonia and recommended to revise chapter 3 in the *Modelling and mapping manual* accordingly. The ICP Vegetation Programme Centre intends to re-structure the chapter to include current annexes in the main text.

4. The ICP Vegetation OZOVEG database on biomass responses of (semi-)natural vegetation to ozone exposure was updated with recently published results. The updated database (OZOVEG2) now includes dose-response relationships for 89 plant species.

5. Maps of the mean heavy metal concentration in mosses in EMEP grid (50 km × 50 km) were finalized for the 1990/1991 and 1995/1996 European moss survey. Between 1990 (1995 for mercury) and 2000, the cadmium, lead and mercury concentration in mosses decreased on average by 42%, 57% and 8%, respectively, which is consistent with the decline in modelled total deposition in Europe of 45%, 52% and 8%, respectively, reported by the EMEP

Meteorological Synthesizing Centre-East (EMEP/MSC-E) for the same period (see EMEP/MSC-E technical report 2/2005). In most countries, a clear decline was also observed for the concentration of copper, vanadium and zinc, but overall no consistent trends were observed for chromium, iron and nickel between 1990 and 2000. The concentration of arsenic in mosses did not change between 1995 and 2000.

Literature

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# Annex V

## International Cooperative Programme on Integrated Monitoring of Air Pollution Effects on Ecosystems (ICP Integrated Monitoring)

1. The fifteenth meeting of the Task Force was held in Zwiesel, Germany, from 10 to 12 May 2007. The programme included a one-day workshop on the assessment of ICP Integrated Monitoring data.

2. ICP Integrated Monitoring was represented at the Task Force meetings of ICP Forests and ICP Waters.

3. Data from ICP Integrated Monitoring sites were used in the following European Union (EU) projects:

(a) CNTER (Carbon and nitrogen interactions in forest ecosystems, www.flec.kvl.dk/cnter);
(b) EURO-LIMPACS (Integrated project to evaluate impacts of global change on European freshwater ecosystems, www.eurolimpacs.ucl.ac.uk);
(c) ALTER-Net (A long-term biodiversity, ecosystem and awareness research network, www.alter-net.info).

4. Scientific work on priority topics continued:

(a) Calculation of pools and fluxes of heavy metals and relations to critical limits and risk assessment. A scientific paper will be finalized in 2007. A summary was included in the programme’s 2007 annual report;
(b) Dynamic modelling. This work had strong links to EU projects. Priority was given to site-specific modelling. A scientific paper based on the first results from site-specific dynamic modelling on climate change impacts on acidification recovery, based on EURO-LIMPACS results, was prepared (Wright et al. 2006). A summary on the use of dynamic modelling forecasts to derive target loads for sulphur and nitrogen in atmospheric deposition, including climate change impacts, was included in the programme’s 2007 annual report;
(c) Nitrogen processes, budgets and carbon-nitrogen interactions. The final report of the CNTER project was published in 2006 (Gundersen et al. 2006). A summary was also prepared (ECE/EB.AIR/WG.1/2007/10);
(d) Arctic Monitoring and Assessment Programme (AMAP). Results from several ICPs and EMEP were used in an assessment report on acidifying pollutants, arctic haze and acidification in the arctic region prepared for AMAP (Forsius and Nyman 2006, www.amap.no). Sulphate concentrations in air generally showed decreasing trends since the 1990s. In contrast, levels of nitrate aerosol were increasing during the arctic haze season at two stations in the

Canadian arctic and Alaska, indicating a decoupling between the trends in sulphur and nitrogen. Chemical monitoring data showed that lakes in the Euro-Arctic Barents region are showing regional scale recovery. Direct effects of sulphur dioxide emissions on trees, dwarf shrubs and epiphytic lichens were observed close to large smelter point sources.

Literature

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## Annex VI

### International Cooperative Programme on Modelling and Mapping of Critical Loads and Levels and Air Pollution Effects, Risks and Trends (ICP Modelling and Mapping)

1. The twenty-second meeting of the Task Force was held in Sofia on 26 and 27 April 2007, after the seventeenth Coordination Centre for Effects workshop held from 23 to 25 April. The Task Force meeting was attended by experts from 21 countries, as well as representatives of other ICPs and organizations outside the Convention. The network of national focal centres (NFCs) was extended to Canada and Slovenia, and there was good cooperation with the United States and China.

2. ICP Modelling and Mapping coordinated and provided effects-related input to the report on sufficiency and effectiveness of the Task Force on Heavy Metals, which forms the basis for the possible revision of the 1998 Protocol on Heavy Metals. In addition, a report, "Heavy metals emissions, depositions, critical loads and exceedances in Europe", commissioned by the Dutch Government, underlined that the focus on the priority heavy metals (mercury, lead and cadmium) was justified from an effects-based perspective.

3. The effects of nitrogen inputs on biodiversity, especially in terrestrial ecosystems, have been the focus in the past years. Empirical critical loads for low deposition areas have been revised and methodologies to derive critical loads of nutrient nitrogen have been substantially developed. A call for voluntary contributions from NFCs on empirical and computed critical loads of nutrient nitrogen and on dynamic modelling resulted in an updated database, which covers large parts of Europe (see ECE/EB.AIR/WG.1/2007/11). A full call for data, which could be used for a possible revision of the 1999 Gothenburg Protocol, is planned for autumn 2007.

4. The exceedance of critical loads of nitrogen is used as headline indicator of risk to biodiversity by the project "Streamlining European Biodiversity Indicators for 2010" (SEBI 2010) and also by Eurostat. Cooperation at national and European levels has explored improved relationships between critical load exceedances, nitrogen impacts and objectives set according to the EU Habitats directive and comparable national legislation. This applies to all areas, including the Natura 2000 areas in EU Member States. The availability of geographical and background information on Natura 2000 areas could be improved.

5. The Task Force emphasized that the aim of European air pollution policies was still to attain critical loads everywhere, in response to a presentation on a project which explored the feasibility of limited emission trading of sulphur and nitrogen oxides in Europe. The Task Force noted that emission trading conflicts with the effects-based approach for pollutants, which have spatially dependent effects. Specifically, the trading would increase the risks for biodiversity on

a larger scale by not protecting ecosystem types in small areas distributed unevenly across Europe, e.g. Natura 2000 areas.

6. The *Modelling and mapping manual* is being updated with critical levels of ozone for forests and of ammonia (see annex IV). For ammonia, an annual average concentration above 1 $\mu g/m^3$ constitutes an exceedance of the critical level, and the monthly critical level of 23 $\mu g/m^3$ is applicable for higher plants only. Updates in the future will include revised dose-response functions for effects on materials and cultural heritage (see annex III) and revised methods and data to determine critical loads of nutrient nitrogen.

7. The Task Force has participated in the development of nitrogen assessment for multiple media and effects for some years. It noted with appreciation the planned establishment of a body focussing Convention work on this subject. It offered to provide relevant knowledge, experience and network structures to help define the mandate and operate the group to be established. It noted that various effects were connected to the nitrogen cascade at national (NFCs) and international levels.

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## Annex VII

### Task Force on the Health Aspects of Air Pollution

1. The tenth meeting of the Task Force on the Health Aspects of Air Pollution was held in Bonn, Germany, on 28 March 2007. Seventeen experts from 15 Parties to the Convention attended the meeting. The World Health Organization's European Centre for Environment and Health (WHO/ECEH) had invited participants from all EECCA countries. Representatives of Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan and Moldova attended the meeting with financial support from WHO.

2. The meeting focused on the discussion of the conclusions from the WHO Workshop on the Health Relevance of Particulate Matter from Various Sources, held on 26 and 27 March 2007, prior to the Task Force meeting. Most experts attended the workshop as well. The main outcomes of the workshop are described in ECE/EB.AIR/WG.1/2007/12.

3. The Task Force reviewed the activities of the EECCA countries assessing health impacts of air pollution. The representatives of the EECCA countries presented concise reports on national activities, which are given in the annex of ECE/EB.AIR/WG.1/2007/12.

4. The Task Force also worked on the WHO report, "Health risks of ozone from long-range transboundary air pollution". It will be updated based on expert feedback and will be finalized in late 2007.

5. The report' "Health risks of heavy metals from long-range transboundary air pollution", is ready for publication.

Literature

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